Madden-Julian Oscillation:
Recent Evolution, Current Status and Predictions

Update prepared by the Climate Prediction Center
NWS / NCEP / CPC
22 August 2022

Overview

- Ongoing Kelvin Wave activity has led to an increase in convection across Africa, with easterly waves beginning to propagate across the Atlantic. This may lead to an increase in tropical cyclone (TC) development over the Main Development Region corresponding with the peak of the Atlantic Hurricane season approaching.

- The enhanced convective envelope over Africa is forecast to slow its eastward propagation, becoming more consistent with a renewed Madden Julian Oscillation (MJO) event across the Indian Ocean and Maritime Continent during the next 2 weeks.

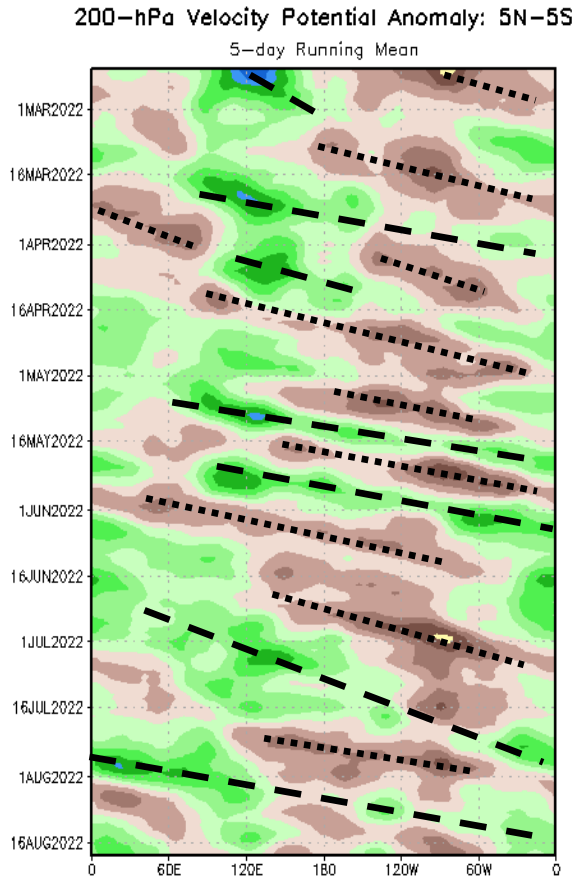
- In the near-term, suppressed convection is forecast across much of the Pacific which may limit TC formation across both the western and eastern Pacific basins, with much of the enhanced convection focused across the Indian Ocean and Maritime Continent.

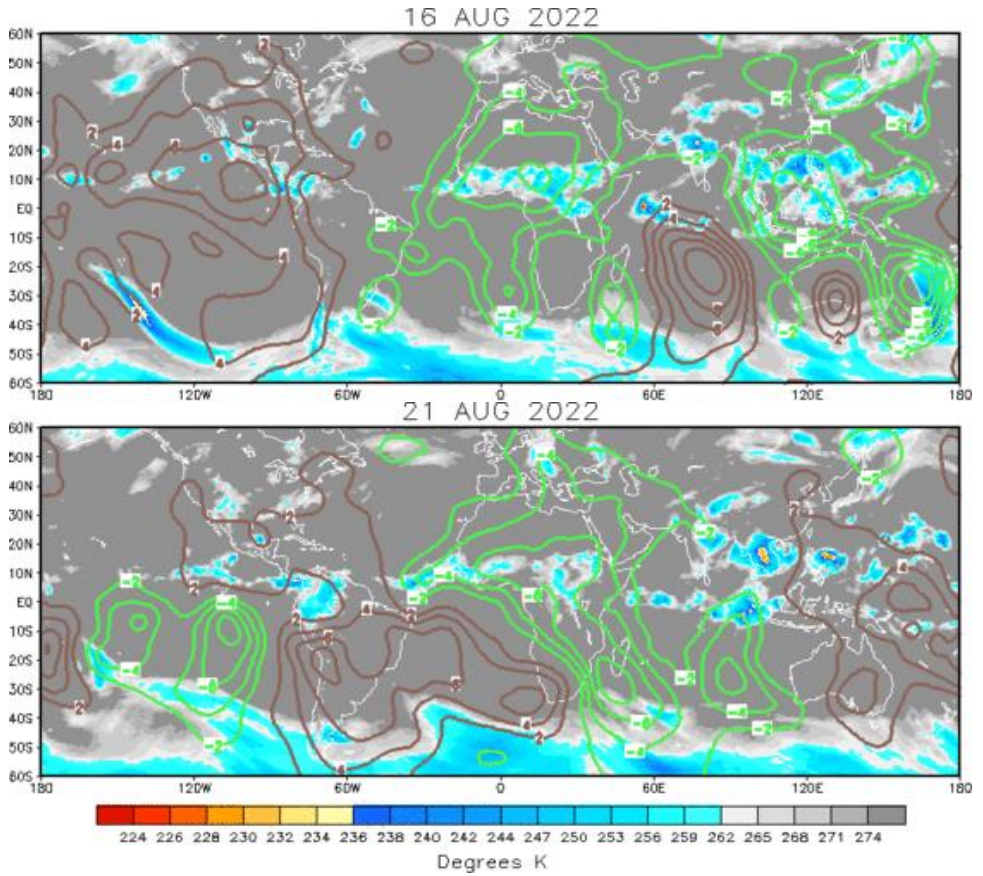
A discussion of potential impacts for the global tropics and those related to the U.S. are updated on Tuesday at:
http://www.cpc.ncep.noaa.gov/products/precip/CWlink/ghazards/index.php

200-hPa Velocity Potential Anomalies

Green shades: Anomalous divergence (favorable for precipitation)

Brown shades: Anomalous convergence (unfavorable for precipitation)

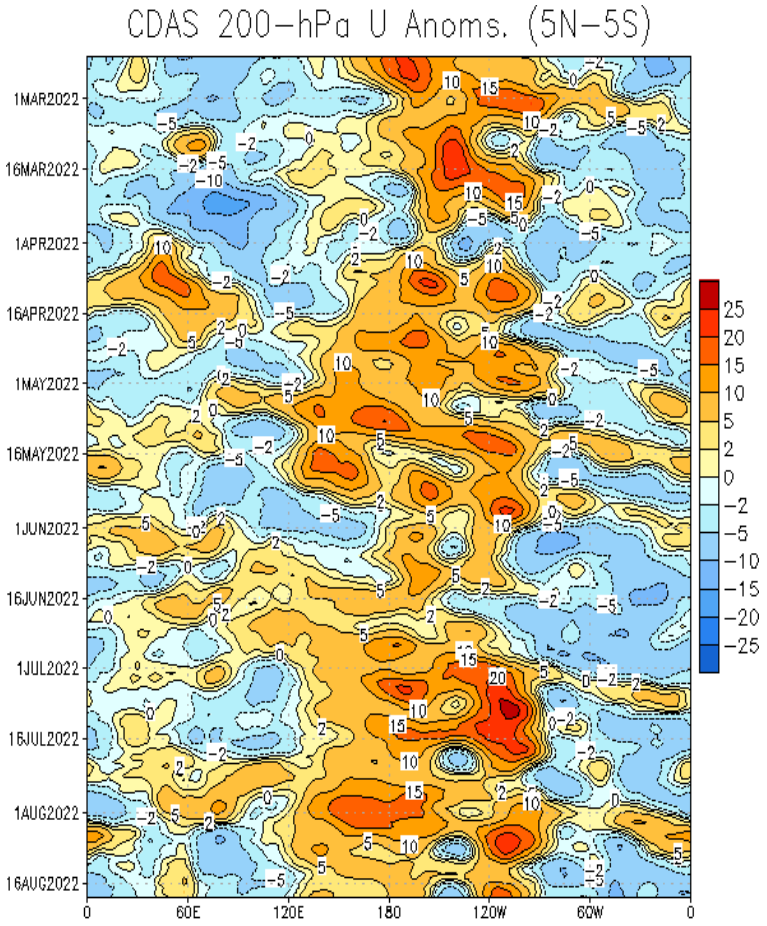


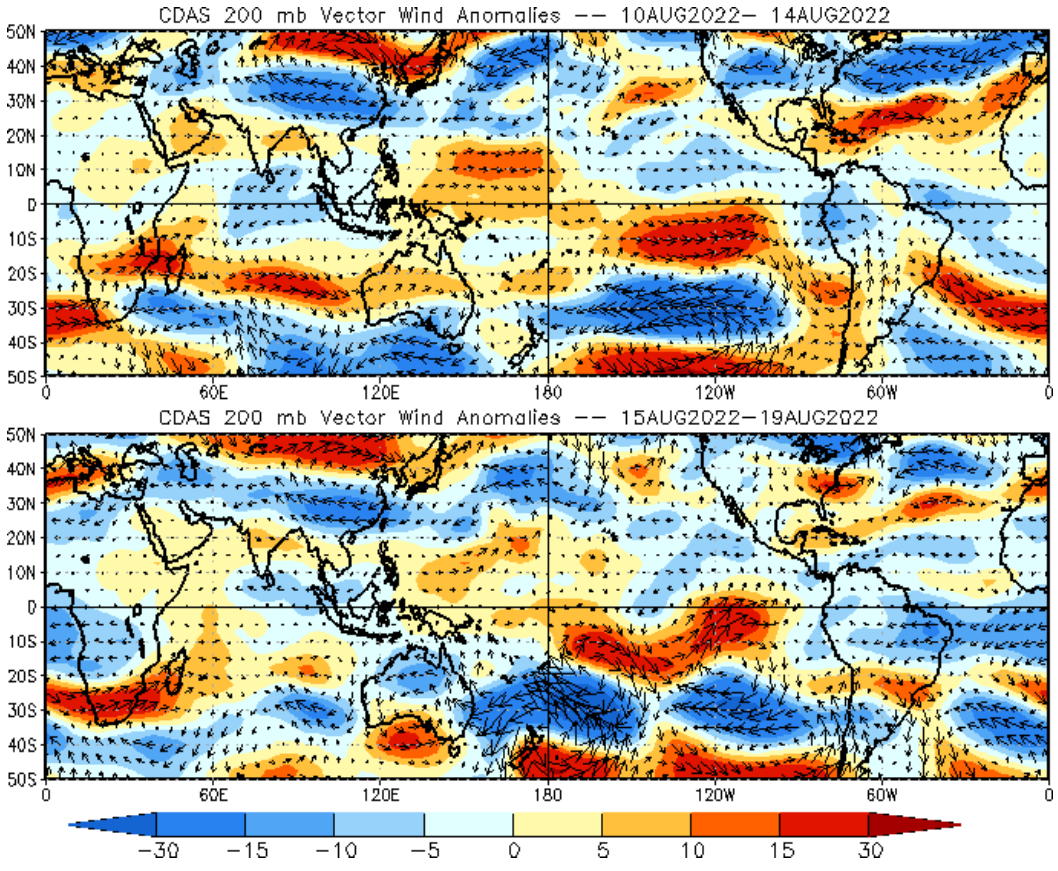


- Increased Kelvin Wave activity resulted in enhanced convection across Africa during the past week.
- Elsewhere, the convective pattern remains disorganized and transient, with areas of suppressed convection across the Pacific, Americas, and western Atlantic, and enhanced convection over the Indian Ocean.

200-hPa Wind Anomalies

Shading denotes the zonal wind anomaly. Blue shades: Anomalous easterlies. Red shades: Anomalous westerlies.

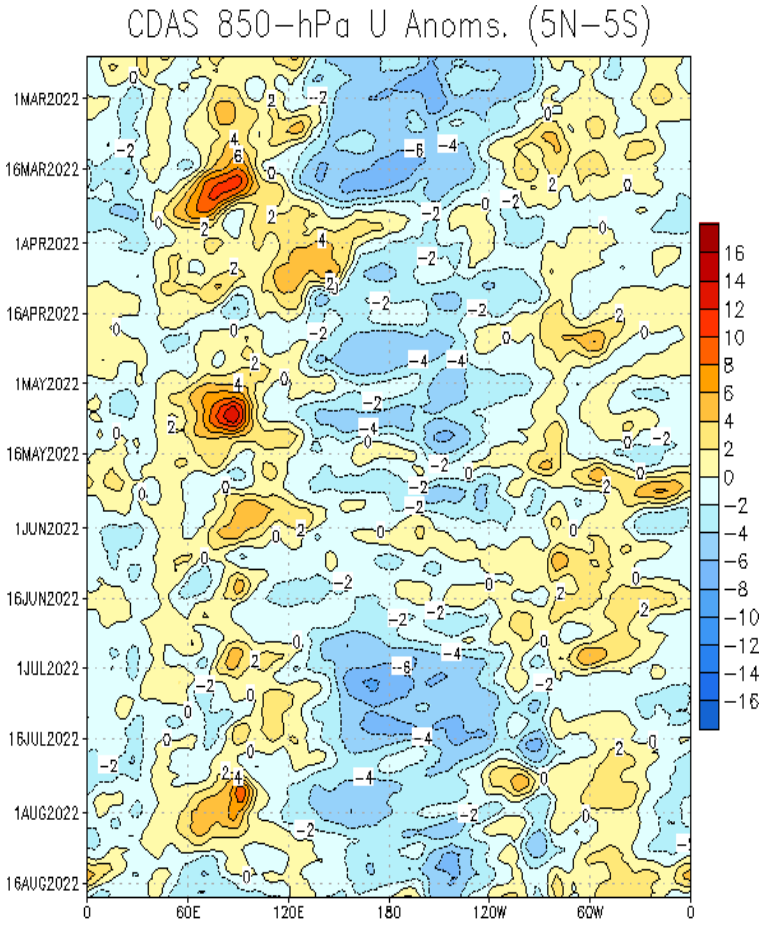


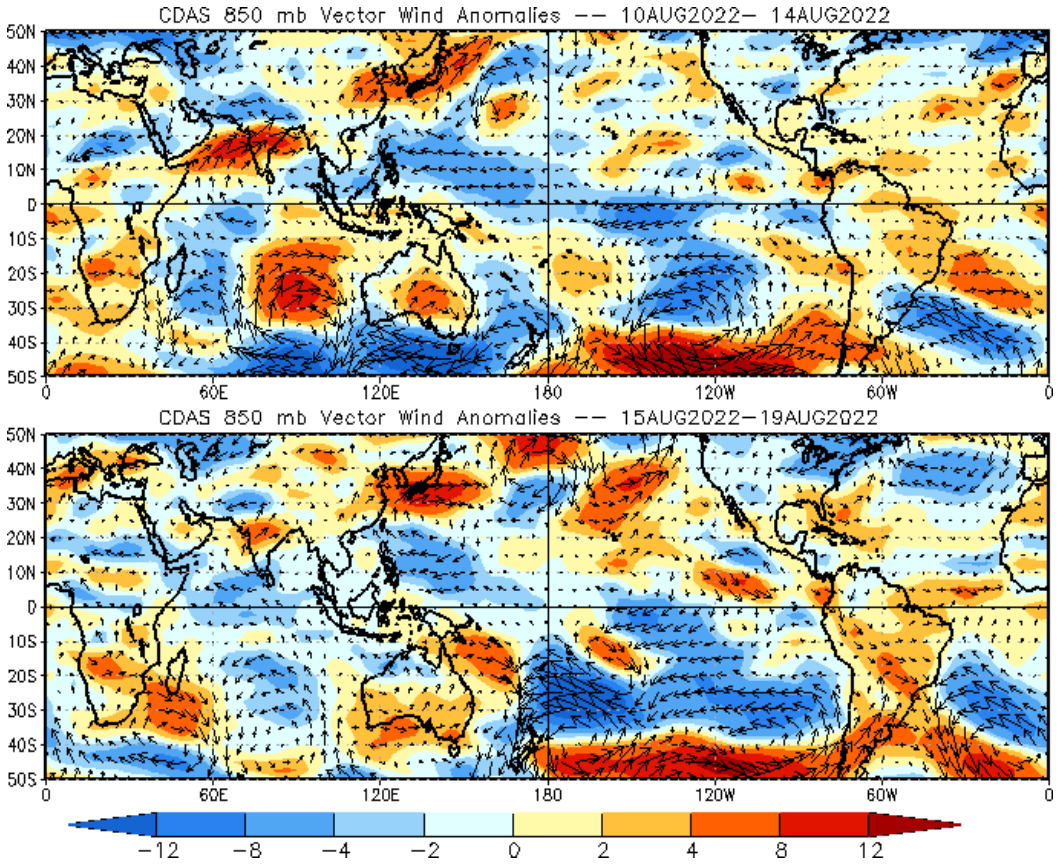


- Anomalous upper-level westerlies continue across the equatorial pacific, consistent with the ongoing La Niña.
- Upper-level westerlies have weakened across the Atlantic compared to last week, signaling a reduction in wind shear across the basin.
- Upper-level easterlies are noted across the southern tip of India, extending through the Maritime Continent and northern Australia, supporting the uptick in convection over the region.

850-hPa Wind Anomalies

Shading denotes the zonal wind anomaly. Blue shades: Anomalous easterlies. Red shades: Anomalous westerlies.

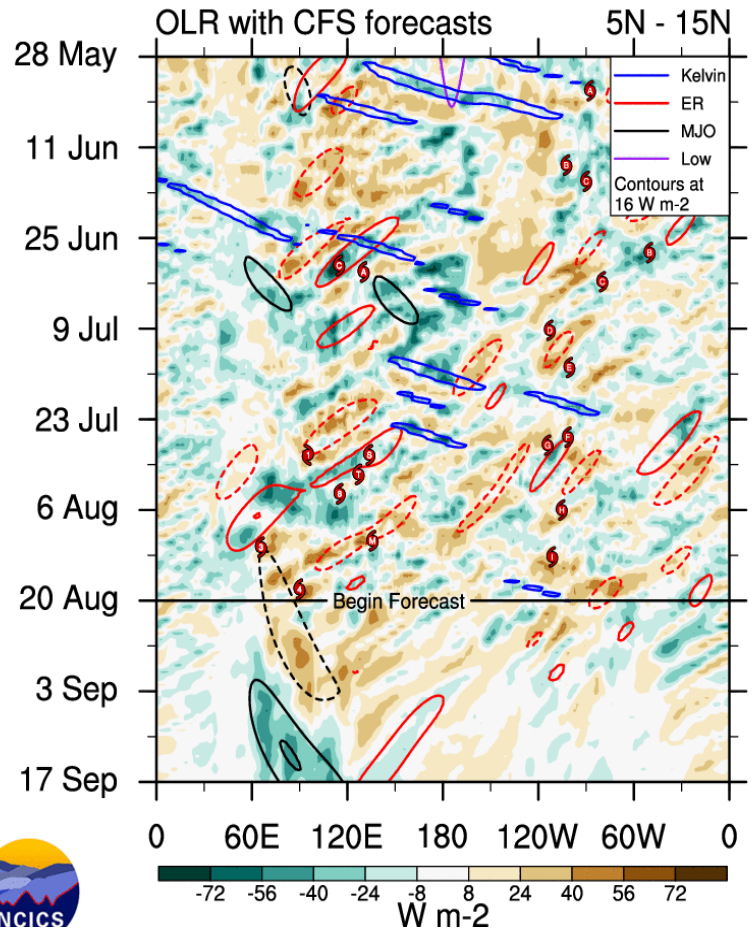


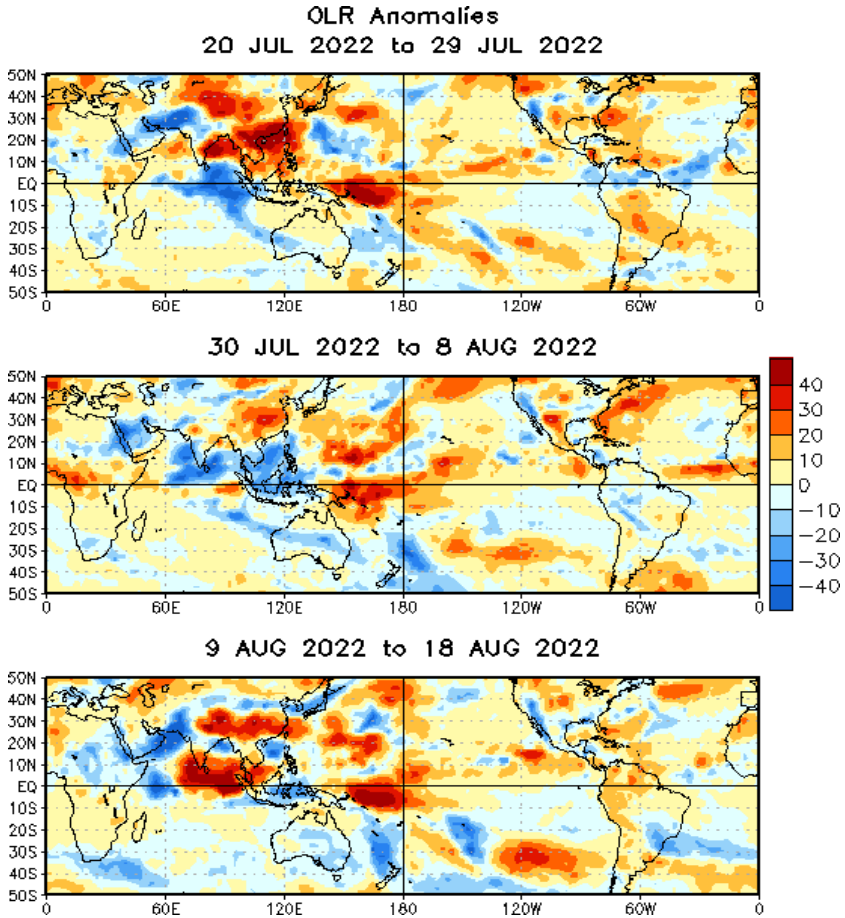


- An anomalous lower-level cyclonic circulation in the south-central Pacific resulted in a reduction in the trades across the equatorial Pacific.
- Anomalous low-level easterlies have increased across the Indian Ocean and parts of Africa, consistent with the ongoing easterly wave propagation.

Outgoing Longwave Radiation (OLR) Anomalies

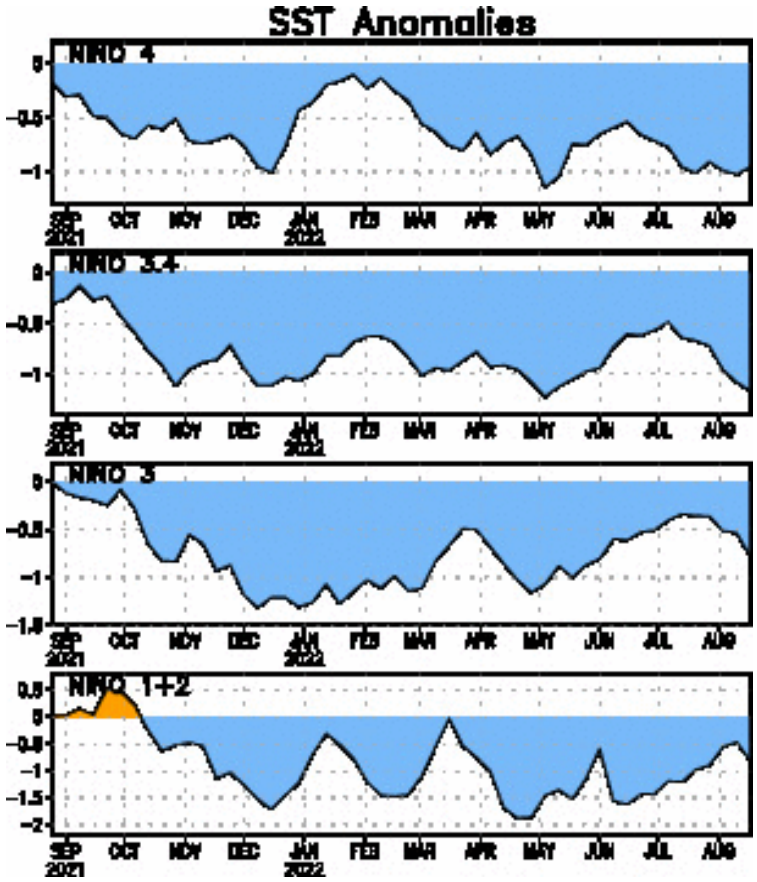
Green shades: Anomalous convection (wetness)
Brown shades: Anomalous subsidence (dryness)

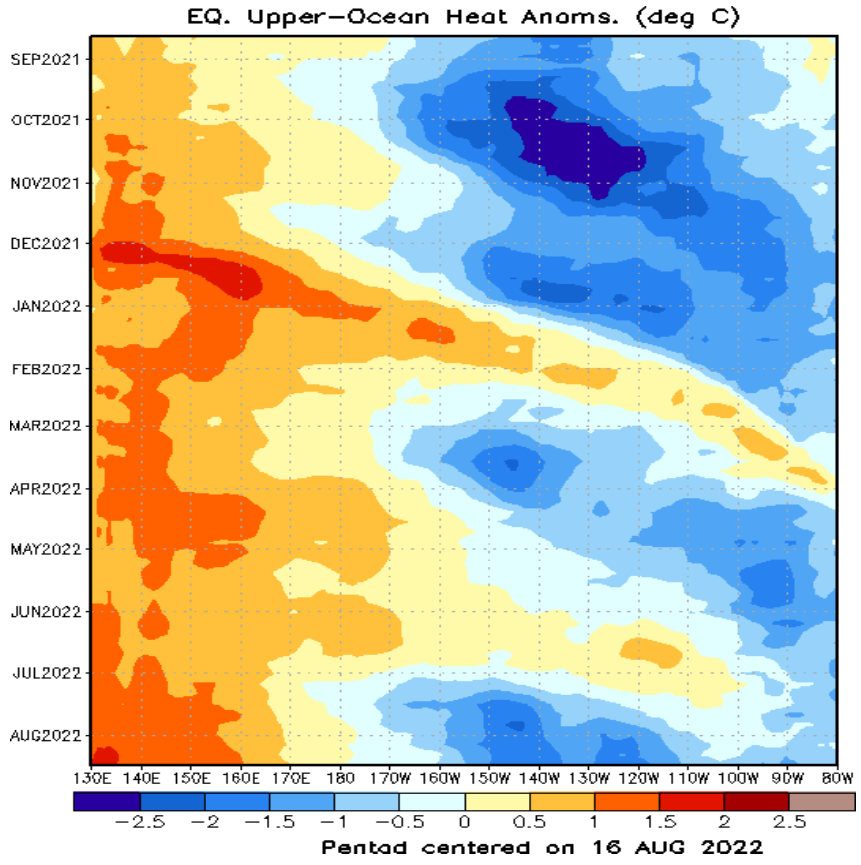




- A strong atmospheric response to La Niña is evident in the OLR anomaly field over the equatorial Pacific, with suppressed convection emerging across Asia and the north Indian Ocean.
- Enhanced convection continues across the southwestern United States with East Pacific cyclones helping to contribute to anomalous moisture since late July.
- The CFS depicts a series of easterly waves emerging off of Africa during the next week which may favor an increase in tropical cyclone activity over the Main Development Region of the Atlantic.

SSTs and Weekly Heat Content Evolution in the Equatorial Pacific

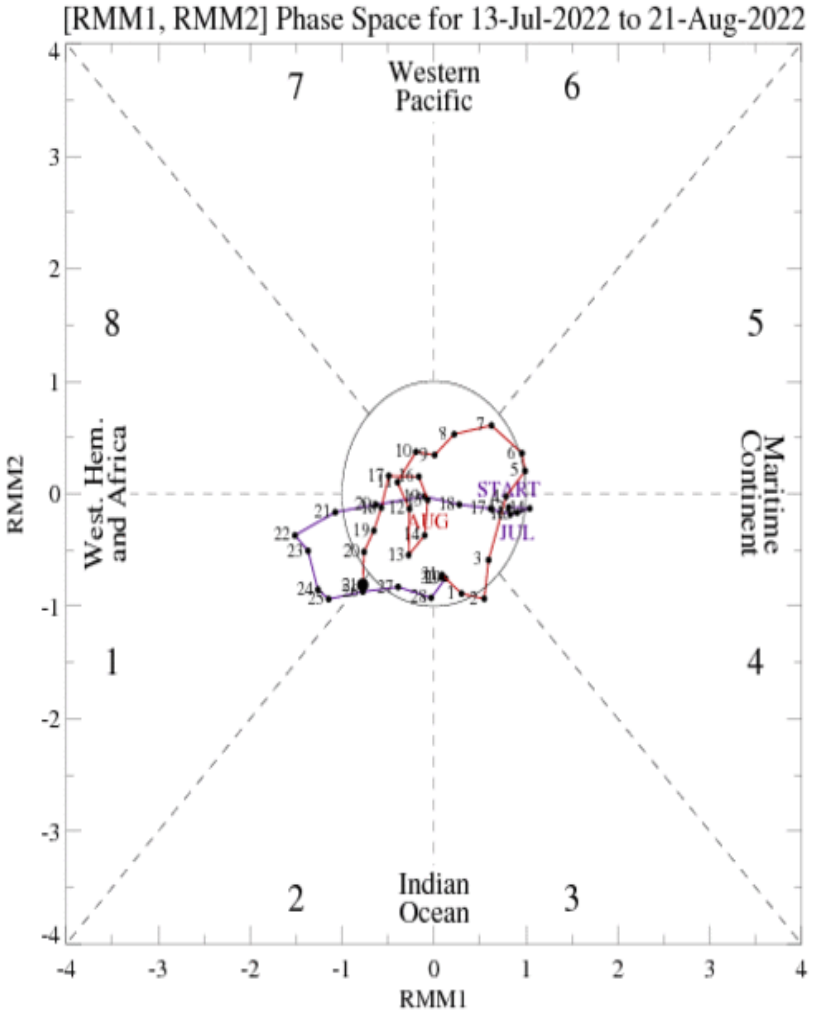




- Following a warming trend in subsurface temperatures over the equatorial Pacific in May and June, enhanced trade winds tied to La Niña resulted in a subsequent upwelling Kelvin Wave leading to a renewed downward trend in subsurface temperatures during July and August.
- SSTs remain below average across all Niño basins, with more pronounced cooling observed in the Niño 3 and Niño 3.4 regions during the past 2 weeks.

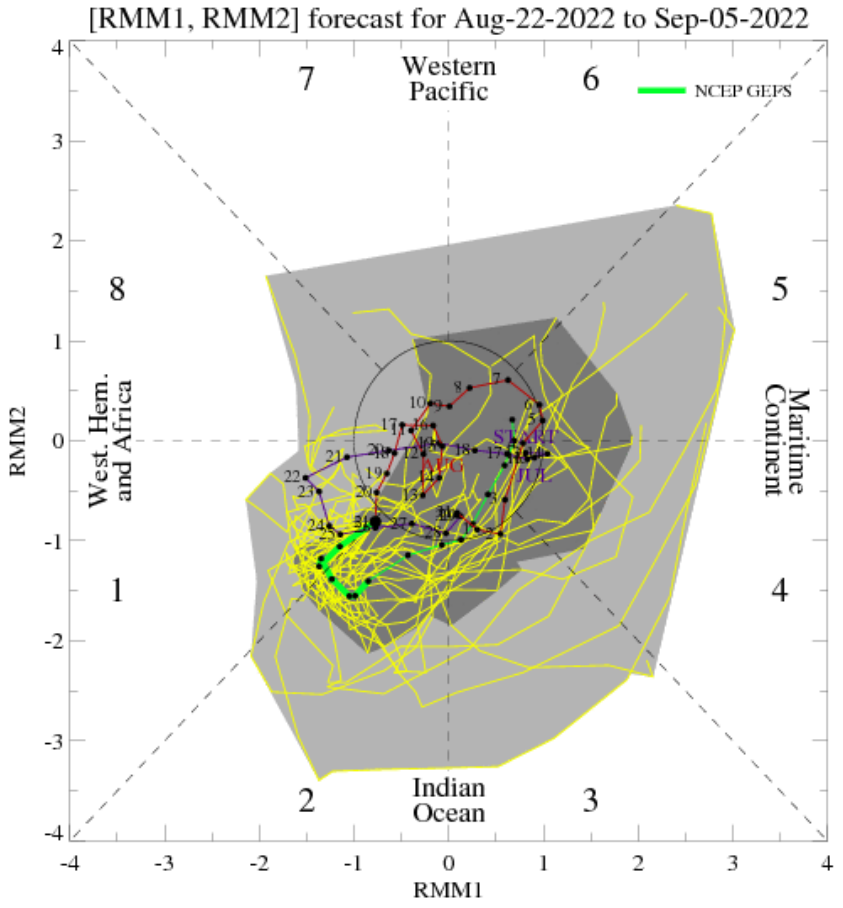
MJO Index: Recent Evolution

- The MJO has remained weak for much of August, although there are hints of the intraseasonal signal emerging across the Indian Ocean during the next week, with its current depiction near the edge of the RMM unit circle on the border of phases 1 and 2.

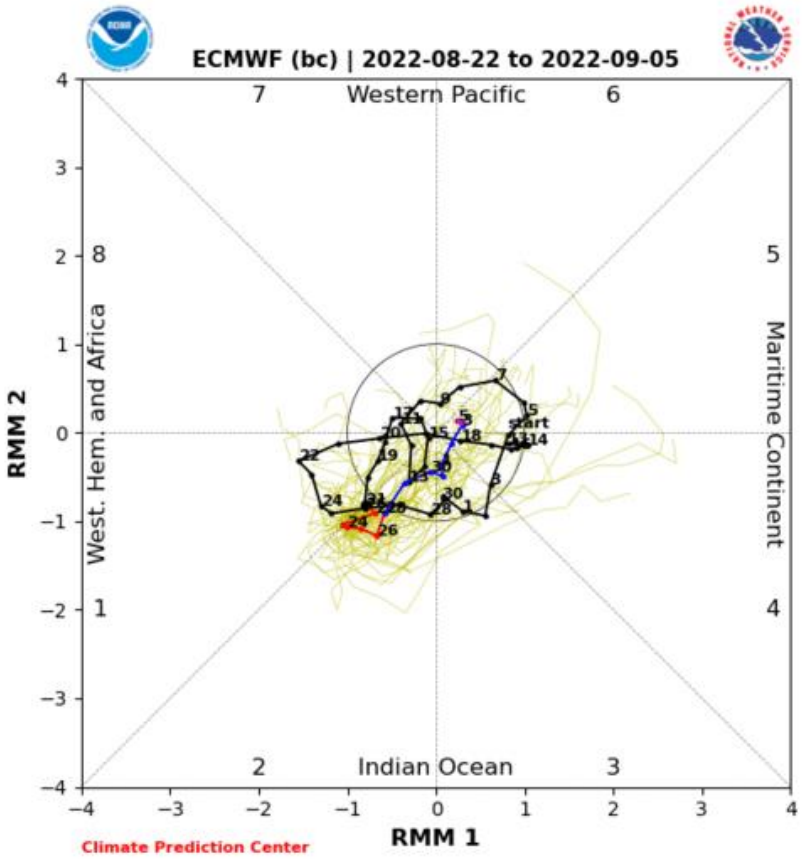


For more information on the RMM index and how to interpret its forecast please see:
https://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/CPC_MJOinformation.pdf

MJO Index: Forecast Evolution



GEFS Forecast



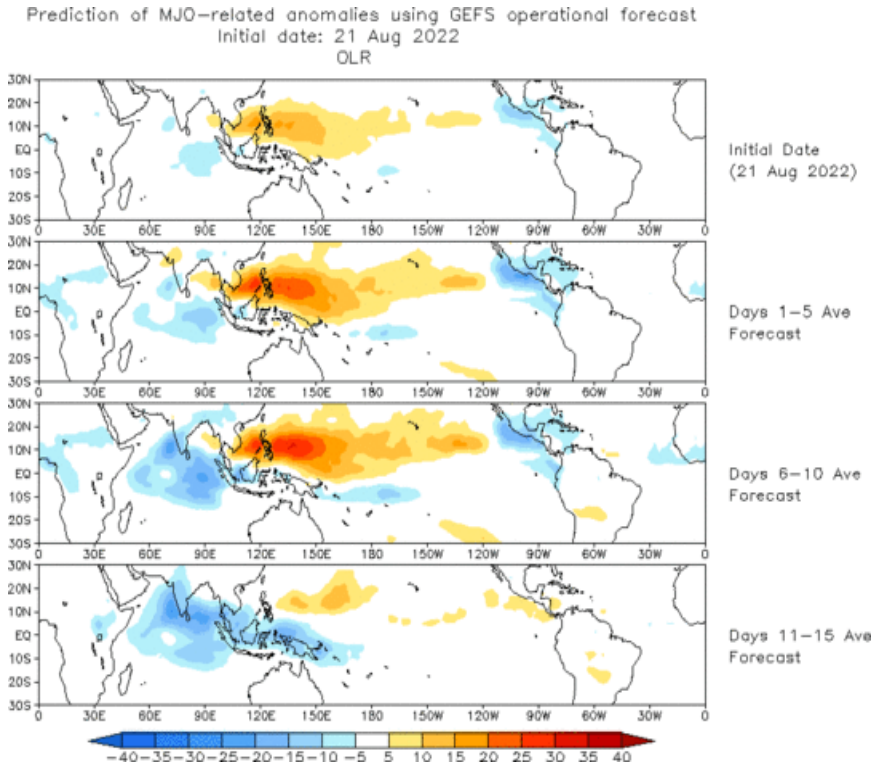
ECMWF Forecast

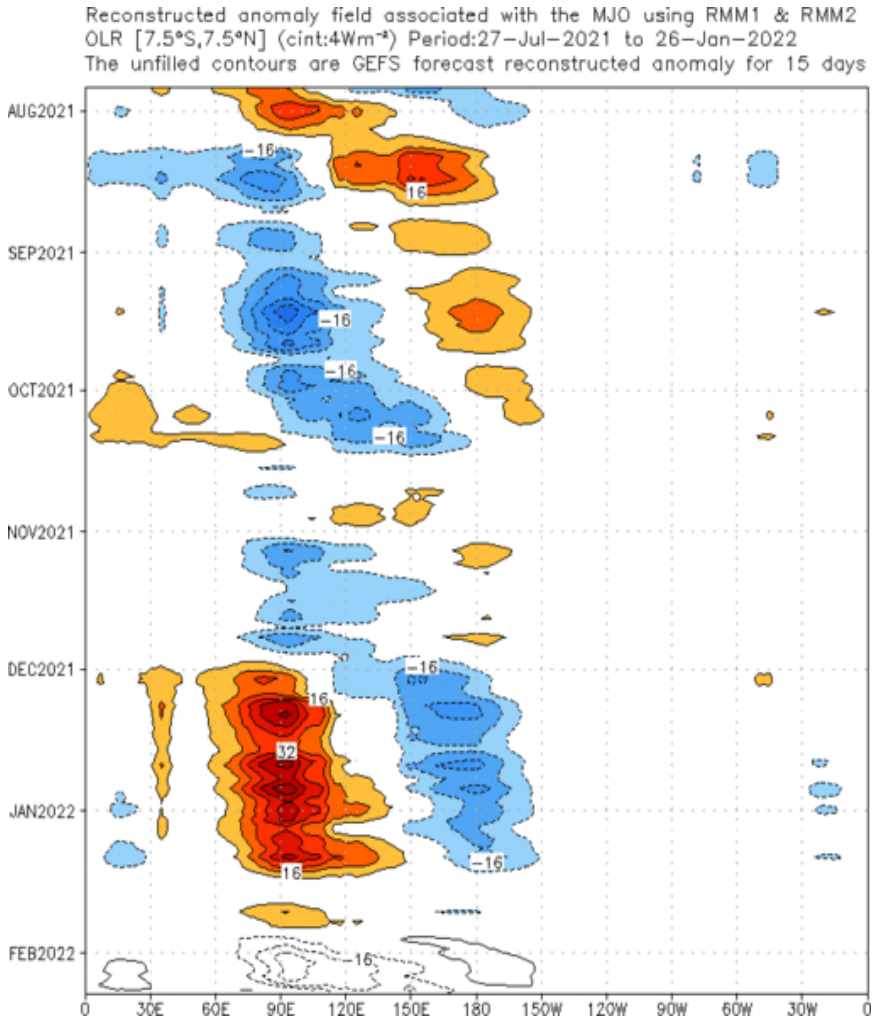
- The GEFS and ECMWF ensembles depict a strengthening MJO event across the Indian Ocean and Maritime Continent during the next 2 weeks.

- However, forecast confidence is low on its longevity given the continued strong atmospheric response associated with La Niña.

MJO: GEFS Forecast Evolution

Figures below show MJO associated OLR anomalies only (reconstructed from RMM1 and RMM2) and do not include contributions from other modes (*i.e.*, ENSO, monsoons, etc.)

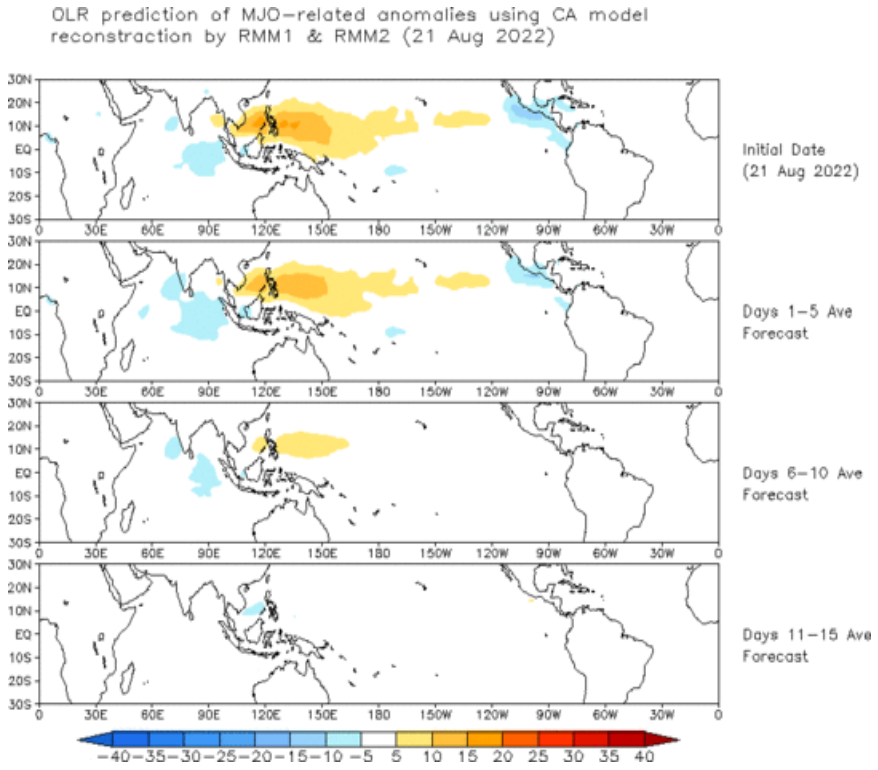


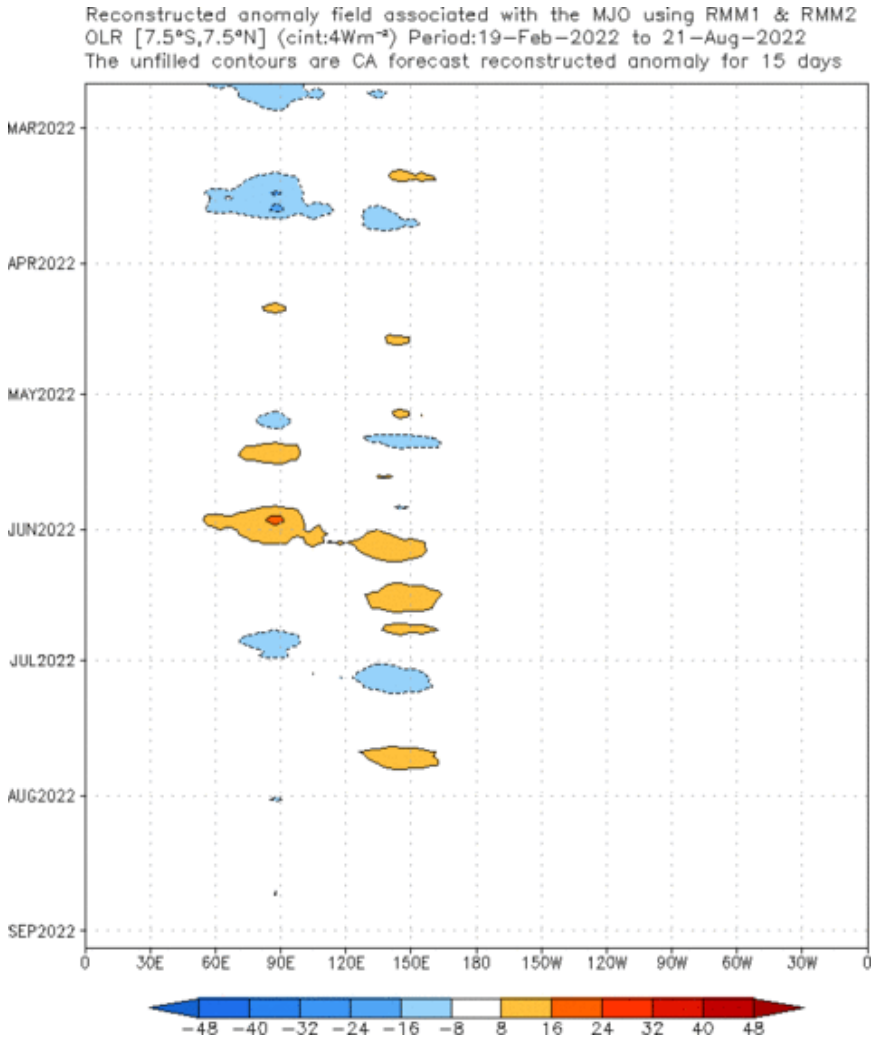


- The GEFS RMM-index based OLR anomaly field favors positive OLR anomalies (suppressed convection) expanding across the Pacific during the next 10 days, with negative OLR anomalies (enhanced convection) increasing across the Indian Ocean and Maritime Continent and weakening over Central America.

MJO: Constructed Analog Forecast Evolution

Figures below show MJO associated OLR anomalies only (reconstructed from RMM1 and RMM2) and do not include contributions from other modes (*i.e.*, ENSO, monsoons, etc.)

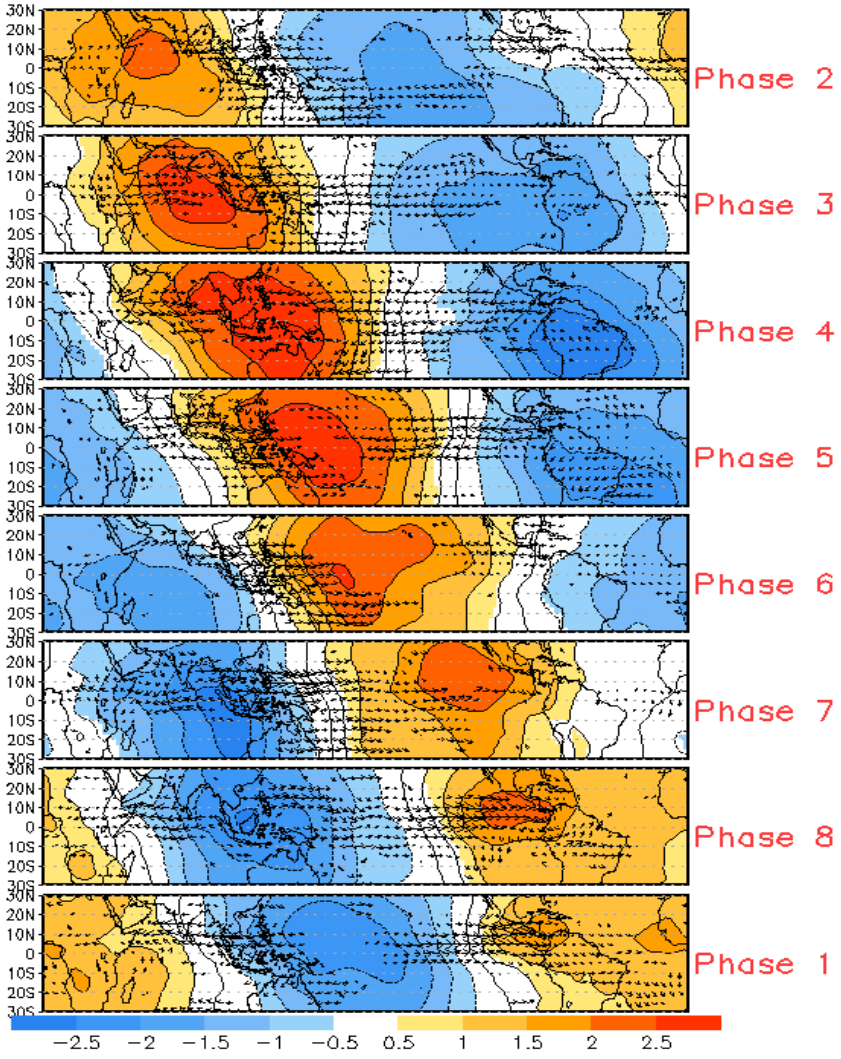




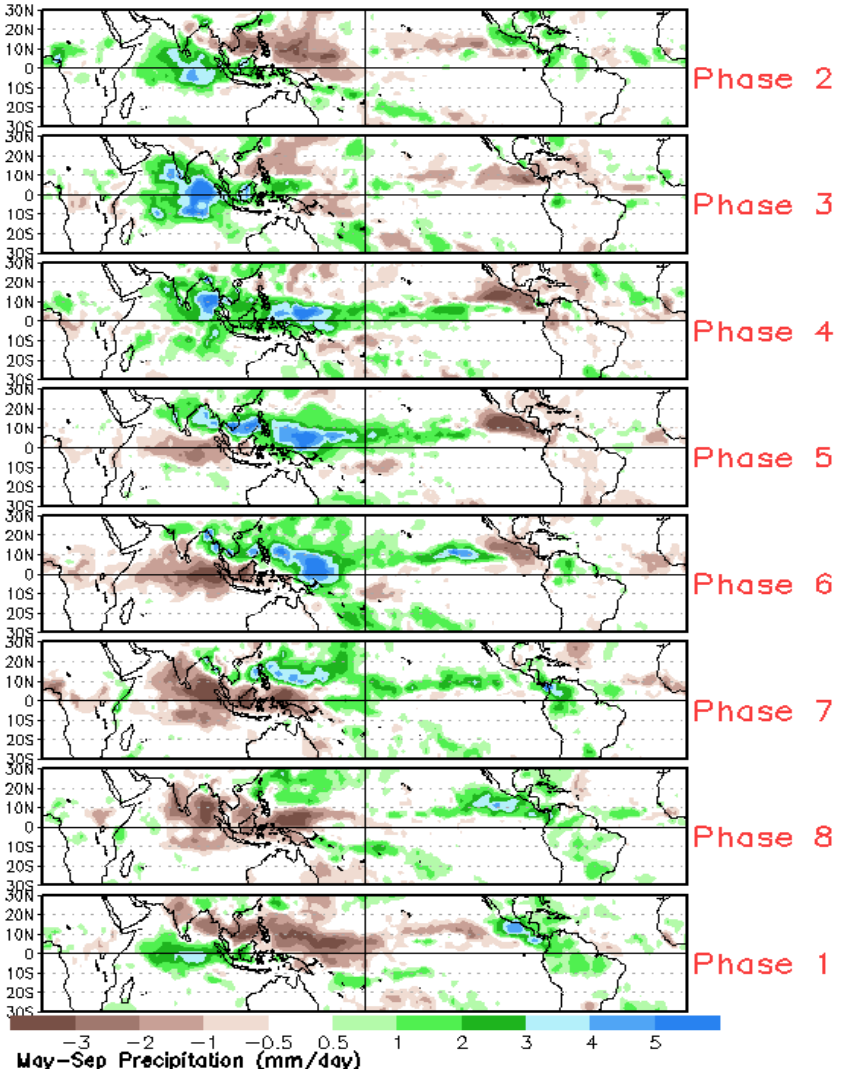
- The constructed analog forecast of RMM-based OLR is similar to the GEFS evolution, with expanding positive OLR anomalies and suppressed convection over the Pacific, but decays the signal during week-2.

MJO: Tropical Composite Maps by RMM Phase

850-hPa Velocity Potential and Wind Anomalies



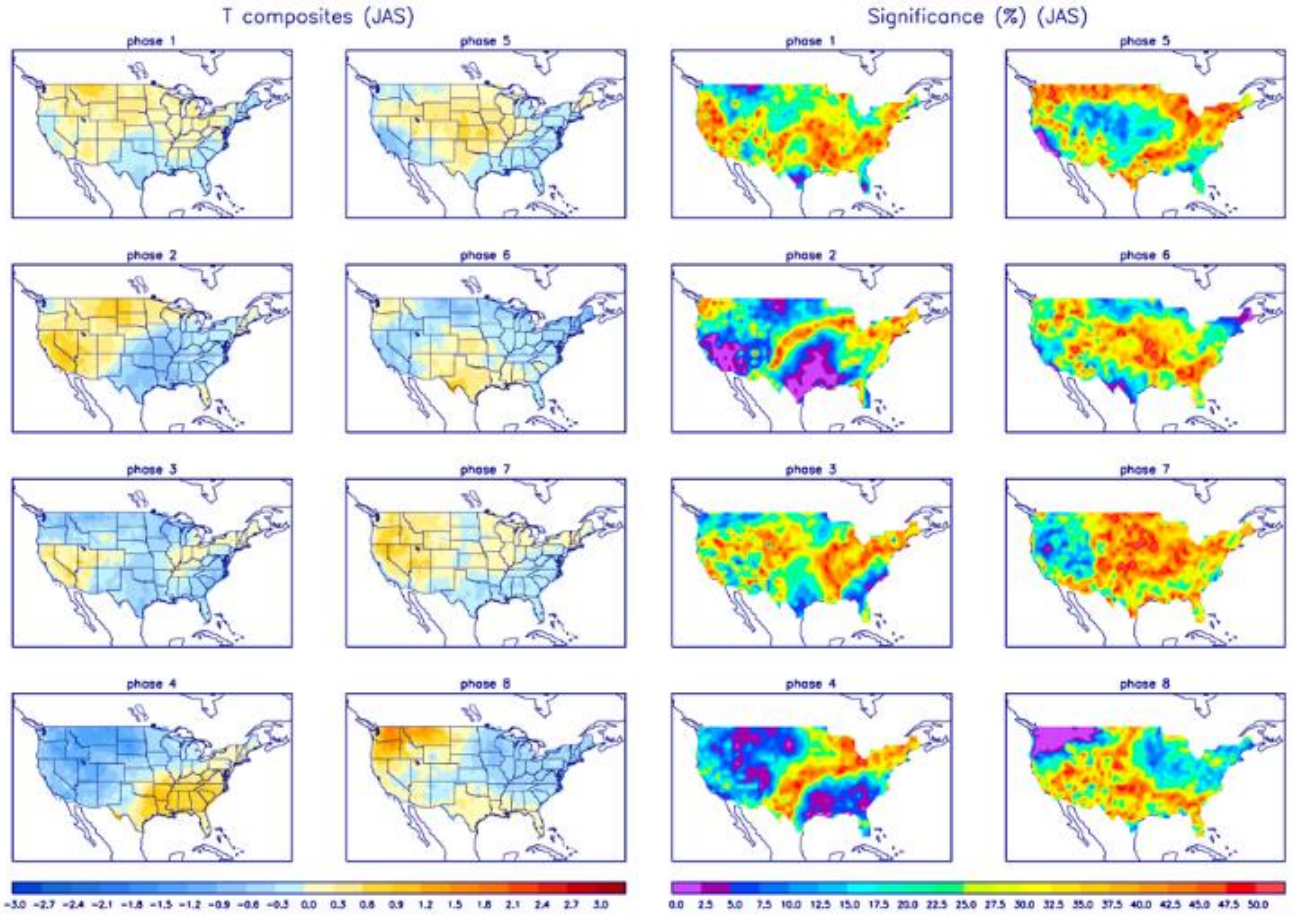
Precipitation Anomalies



MJO: CONUS Composite Maps by RMM Phase - Temperature

Left hand side plots show temperature anomalies by MJO phase for MJO events that have occurred over the three month period in the historical record. Blue (red) shades show negative (positive) anomalies respectively.

Right hand side plots show a measure of significance for the left hand side anomalies. Purple shades indicate areas in which the anomalies are significant at the 95% or better confidence level.

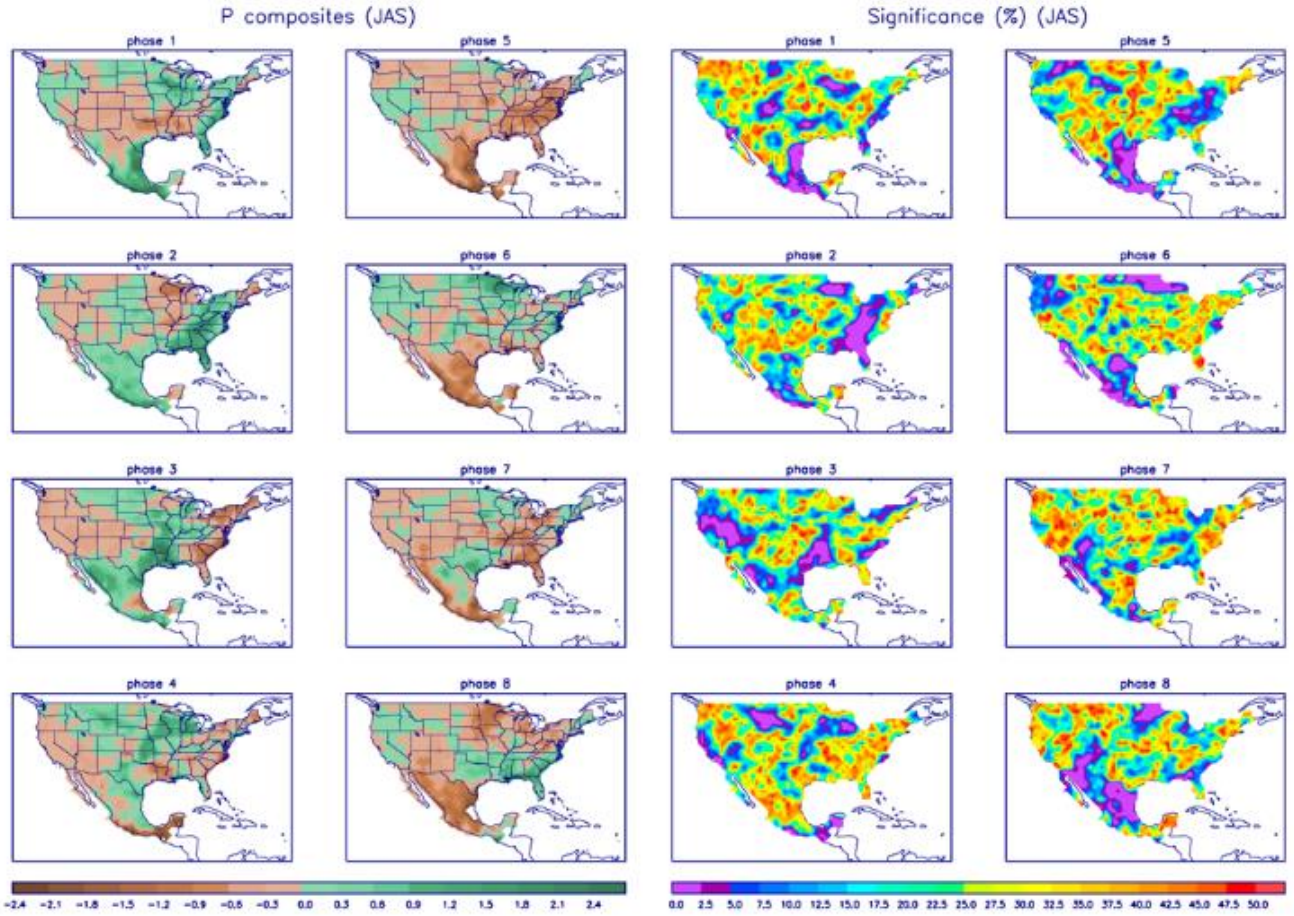


More information: http://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/mjo.shtml

MJO: CONUS Composite Maps by RMM Phase - Temperature

Left hand side plots show precipitation anomalies by MJO phase for MJO events that have occurred over the three month period in the historical record. Brown (green) shades show negative (positive) anomalies respectively.

Right hand side plots show a measure of significance for the left hand side anomalies. Purple shades indicate areas in which the anomalies are significant at the 95% or better confidence level.



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